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STORAGE

Memoirs of the Department of Agriculture in India

MILLETS OF THE GENUS SETARIA IN THE BOMBAY PRESIDENCY AND SIND

BY

G. A. GAMMIE, F.L.S

Imperial Cotton Specialist

Formerly Economic Botanist, Bombay

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MILLETS OF THE GENUS SETARIA IN THE BOMBAY PRESIDENCY AND SIND.

By G. A. GAMMIE,

Imperial Cotton Specialist.

Sir J. D. Hooker, in his account of the grasses in the "Flora of British India," admits about 10 species in the genus Setaria of which seven are found in India and Ceylon. These are :—

(1) S. italica, *Beauv.*, is cultivated, throughout India and in most tropical and temperate countries.

(2) S. glauca, *Beauv.*, is cultivated, so far as we at present know, only in one part of the hill country in the Poona district, and, perhaps, also near Khanapur in the Belgaum district of the Bombay Presidency. As a wild grass, it is also distributed throughout tropical and temperate regions.

(3) S. intermedia, *Roem and Sch.*, and

(4) S. verticillata, *Beauv.*, are two very closely allied species, abounding during the rains in rich soil in low-lying places and often where refuse has been thrown, but useless as fodder on account of their harsh nature. Duthie, however, says of the latter that cattle will eat it when young, that is, before the flowering spikes appear and that the grain is eaten by poor people. Symonds remarks that cattle will not eat it, so it is considered a troublesome weed wherever found, and that it is common about rubbish heaps all over India.

(5) Sir J. D. Hooker is disposed to consider that S. viridis, *Beauv.*, is possibly the wild form of S. italica. This grass does not extend southwards so far as any part of the Bombay Presidency.

(6) S. gracillima, *Hook. f.*, is confined to Ceylon, and finally there is

(7) S. forbesiana, *Hook. f.*, which has been recorded from the Konkan by Lisboa.

The purpose of this note is to describe the two cultivated species of the genus as found in the Bombay Presidency only. The descriptions are founded on many plots of specimens raised from grain received from all districts during the seasons 1906-1907. The characters of the genus with its two species may be shortly expressed as follows :—

SETARIA.

Annual, tufted grasses. *Spikelets* smooth, one flowered, awnless, shortly stalked, articulate and clustered on the very short branches of a spiciform panicle, subtended by persistent involucels of few or many barbed bristles (barren branches) which are usually connate at the very base. *Glumes* 4, membranous, with the exception of IV, which becomes bony, I equal to $\frac{1}{3}$ III or shorter, II almost equal to IV, III neuter, paleate, IV at first coriaceous, becoming bony, plano-convex, bisexual, paleate, *pale* coriaceous, *stamens* 3, *styles* 2, distinct, penicillate at the tips. *Grain* small, free, but permanently enclosed within the thickened glume and pale.

A short, densely tufted plant, *spikes* erect, narrow. *Bristles* 6 to 8 below each spikelet. *Glume* IV transversely rugose . . 1. S. glauca.

Taller, not densely tufted. *Spikes* usually nodding, broader and longer, *bristles* 1 to 9 below each spikelet. *Glume* IV quite smooth . . . . . 2. S italica.

Spikes straw coloured ; with short or no bristles, secondary spikes arranged spirally, surfaces convex, their

breadth at the base of each branch more than $\frac{1}{2}$ their length. . . . . 2 (a). S. italica (type).

Spikes straw-coloured, with long bristles, secondary spikes, too closely aggregated to show a spiral arrangement. . 2 (b). S. italica. *Var. nov.* barbata.

Spikes purple brown, uppermost branches only crowded, lower secondary spikes much laxer than in the last, their breadth at the base of each branch equal to $\frac{1}{2}$ or less than $\frac{1}{2}$ their length. . . . . 2 (c). S. italica. *Var. nov.* purpurea.

Spikes brown, crowded, cylindrical or slightly club-shaped, broad at apex, almost erect, bristles only slightly exceeding the spikelets. . . . . 2 (d). S. italica. *Var. nov.* typhoidea.

1. Setaria glauca. *Beauv., Agrost.* 51 : *Hooker Fl. Br. Ind., VII. p.* 78 : *Dalz. & Gibs., Bomb. Fl., p.* 293 : *Duthie, Grasses of N. W. India, p.* 8 : *Indigenous Fodder Grasses, pl. X ; Fodder Grasses of Northern India, p.* 14 ; *Lisboa, Bombay Grasses, p.* 33 : *Mollison, Text Book on Indian Agriculture, III. p.* 67 : *Symonds, Indian Grasses, p.* 42, *pl. XXVI.*

Vern.—Marathi (as a grain crop), *Barati ;* (as a grass) Hindustani, *Bandra, Bandri ;* Marathi, *Bhadli.*

One to two feet high, densely tufted. *Leaves* pale green, rather weak and narrow, smooth below, scabrous above, *ligule* minute, 3—4-sected. *Spikes* erect, yellow, narrow, completely cylindrical, the lower half often barren, 1 to 6 inches long by $\frac{3}{8}$ inch broad, including the bristles which are yellow and $\frac{1}{4}$ inch long, pointing upwards, barbed, 6 to 8 in each spikelet. *Spikelets* $\frac{1}{8}$ inch long, green, sessile on the slender axis of the spike. *Glume* I, minute, II equal to $\frac{1}{2}$ IV, 3-nerved, III paleate equal to IV, which is coriaceous white and transversely rugose, its *pale* is also white.

Cultivated as a *kharif* crop in the Mulshi Petha of the Poona district, and probably also near Khanapur in the Belgaum district.

Mr. Mollison writes in his Text-book on Agriculture that "a good crop stands about two feet high. The plants have enormous tillering power. A thick crop can, therefore, be got from a small seed rate, provided the seed is equally scattered in sowing. The stalks are very fine, the leaf growth considerable and the fodder at least good. The outturn of fodder per acre is not, however, heavy. This grass is sparingly cultivated in the hilly parts of the Deccan on comparatively light soil with moderate rainfall. *Barati* is a rains' crop sown in June-July and reaped in October-November."

The grain of the wild plant is used as food in the Central Provinces and Chutia Nagpur.

Duthie says of the grass in a wild state that it is common all over the plains of India, and attains moderate elevations on the hills, and that it is generally considered to be a fairly good fodder grass. It thrives best on rich or cultivated ground. Symonds states that it appears a moderately good fodder, but is unsuitable for making hay. In Australia it is highly relished by stock. In the United States where it is known as "Pigeon or Bottle Grass," it furnishes fodder which is considered as good but less productive than that of "Hungarian Grass" (*S. italica*).

2. Setaria italica, *Beauv. Agrost., p.* 51 ; *Hook. Fl. Br. Ind., VII, p.* 78 ; *Duthie, Grasses of N. W. India, p.* 8 ; *Field and Garden Crops, part* 2, *p.* 5, *pl.* 25 ; *Fodder Grasses of Northern India, p.* 15.

Panicum italicum, *Dalz. & Gibs., Bomb. Fl. Suppl., p.* 98, ? Panicum pilosum, "Badlee," *id. l. c. p.* 98, ? P. –(?) sp. ("Rale"), *id. l. c. p.* 98.

2 (a). Setaria italica (type).

Attaining the height of $4\frac{1}{2}$ feet. *Culm* yellow, moderately robust, *nodes* tumid smooth, *internodes* short, *sheaths* smooth, longitudinally close striate, margins ciliate, *ligules* $\frac{1}{16}$ inch long, irregularly partite or fimbriate. *Leaves* 12 to 18 inches long, by $\frac{1}{2}$ to 1 inch broad, light green in color, linear lanceolate acuminate, base slightly suffused with brown, blade with both surfaces scabrous, midrib distinct, white, strong, lateral nerves

five on each side, weaker nerves numerous, indistinct. *flag* with a long sheath, *blade* shorter than or exceeding the inflorescence. *Peduncle* long and slender. *Spike* curved and nodding, up to $8\frac{1}{2}$ inches long, and $1\frac{1}{4}$ inch broad, including the very short bristles (which, however, in poor examples are often longer, while they are altogether wanting in the finest variety), lower branches only slightly scattered, upper densely aggregated, all distinctly arranged in a spiral manner with convex surfaces, *rachis* creamy white, densely white pilose. *Spikelets* subsecund on the branches yellowish green, in clusters of 40 to 50, *bristles* few, white, only attaining $\frac{1}{8}$ inch in length, pointing upwards, *spikelets* ovoid, slightly constricted near base. *Glume* I equal to $\frac{1}{3}$ III, ovate, 3-nerved below apex : *Glume* II shorter than IV, elliptic, 5-7-nerved : *Glume* III almost equal to II, paleate, 5-7-nerved : Glume IV *pale* yellow, protruding when ripe.

2 (b). Setaria italica, *Beauv. var. nov.* barbata.

This differs from the type described above in the following points :—

Spikes up to 9 inches long but usually much shorter, the two lowest branches often remote, the upper more densely aggregated and scarcely showing the spiral arrangement. *Spikelets* distinctly secund on the branches, in clusters of 12 to 16, *bristles* 3 to 9 at the base of each spikelet, $\frac{5}{16}$ inch long, often altogether absent in the uppermost spikelets. *Spikelets* $\frac{1}{8}$ inch long, constricted near the base. *Glume* IV *pale* white.

2 (c). Setaria italica, *Beauv. var. nov.* purpurea.

This differs as follows from the above named varieties :—

Internodes yellow, suffused with brown, bases of leaves distinctly brown. *Leaves* dark green. *Spikes* up to 9 inches long, the smaller sometimes erect, the larger invariably curved and drooping, *lower branches* slightly scattered, *central* loosely, and *uppermost* densely aggregated, *rachis* suffused with brown purple, densely setose with white hairs, secondary spikes dense, with about 20 spikelets in each, *bristles* usually single, almost $\frac{1}{2}$ inch long, brown, spikelets as above. *Glumes* I, II and III suffused

with purplish brown, IV bright yellow, ultimately becoming orange red. *Grain* white as usual.

2 (d). Setaria italica, *Beauv. var. nov.* typhoidea.

This variety was received from Sind only and is characterised as follows :—

Height $3\frac{1}{2}$ feet. *Leaves* about 18 inches long and $\frac{3}{4}$ inch broad. *Spikes* purple brown, cylindrical or slightly club-shaped, broad at apex, length 5 inches, breadth 1 inch, *bristles* slightly exceeding the spikelets. *Glume* III narrower and more acuminate than in any of the other varieties.

General remarks on Setaria italica and its varieties.

The result of my analysis of many samples under vernacular names is that the name *Chino* is applied in Sind to the variety which I have called *typhoidea ; Savri* is applied in Sind to S. italica *type ;* the Marathi names, *Rala*, *Kang* and *Bhadli* are given to all varieties indifferently ; *Kang* is the Gujarati term ; while *Navani* seems to be the correct name in Kanarese, although *Kang* is also used.

Sir George Watt and Mr. J. F. Duthie state that S. italica occurs wild in India on parts of the Himalayas. De Candolle, however, doubts whether it has been found truly wild anywhere. He asserts that the species existed before all cultivation, thousands of years ago, in China, Japan, and the Indian Archipelago. Its cultivation must have early spread towards the West since we know of Sanskrit names, but it does not seem to have been known in Syria, Arabia and Greece, and it is probably through Russia and Austria that it early arrived among the lake-dwellers of the Stone age in Switzerland.

Mr. Duthie says that "S. italica is both wild and cultivated in India and largely grown in other warm countries. In Northern India it is usually sown as a subordinate crop accompanying *Juar* (Andropogon Sorghum) or *Sawn* (Panicum frumentaceum). It is cultivated on the Himalayas at low elevations. Its abundant and nutritious foliage yields an excellent forage if cut

when in blossom." In Australia it is considered to be a good, fattening, pasture grass. In the United States, where it is known under the name of "Hungarian Grass" it is much valued. Professor Phares quoted by Dr. Vasey remarks, "if cut at the right stage the whole plant is a safe and very valuable forage."

Mr. Mollison says "the grain is very easily rubbed out from the head of grain. It varies in size and colour according to variety. The seed is oval, more pointed at one end than the other, smooth, shining. The more common colours are creamy white, dirty creamy white, yellow orange, light red brown. In one variety brownish black glumes enclose creamy white seeds. In the Bombay Presidency, the crop is annually becoming more popular and the area has considerably increased within recent years. It is a quick growing cereal and a suitable crop to grow after a period of famine or scarcity. It produces a good deal of grain and a fair amount of fodder in quick time. It thrives best in medium light soil and does better than other millets with deficient rainfall. The straw makes good fodder."

Professor Church, in his analysis of the grain, gives the Nutrient Ratio or Albuminoids to Starch 1 : 7·4 : Percentage of Albuminoids 10·8 ; Nutrient value 91, and the following details:—

Composition of Husked (Italian) Millet.

	In 100 parts.	In 1 lb.
Water	10·2	1 oz. 277 grains.
Albuminoids	10·8	1 ,, 318 ,,
Starch	73·4	12 ,, 63 ,,
Oil	2·9	0 ,, 203 ,,
Fibre	1·5	0 ,, 105 ,,
Ash	1·2	0 ,, 84 ,,

In Dalzell and Gibson's Bombay Flora, Supplement, page 98, the authors give the following species, which must all go under one or other variety of Setaria italica :—

"9. Panicum italicum, *Roxb. Fl. Ind. I., p.* 302, *Kangnee. Kora, Kang,* a small grain, cultivated in the Ghat districts ; spikes a little different from those of P. frumentaceum.

"11. P. pilosum, 'Badli,' Echinochloa hispidula. Is cultivated more inland than the former three species and distinguishable by the long hairy rough spikes clustering all round the rachis."

[Sir J. D. Hooker, in the Flora of British India, may have reduced this to Panicum crus-galli, *Linn. var.* frumentacea after examination of Dalzell and Gibson's original specimens, but the description points without doubt to a variety of S. italica, which is often known as *Bhadli* in the Deccan districts, while I have no record of that name being applied to P. crus-galli. The spikes of the latter (P. crus-galli) are not long hairy and they certainly do not cluster all round the rachis.]

"12. P.—(?) sp.—'Rale,' much less hairy than the last, probably only a variety. The grain is deemed very nutritious and is a favourite food in cases of exhaustion. This is most certainly the typical form of S. italica."

In a more recent paper by Dr. J. Walter Leather, entitled "Indian Food-grains and Fodders, their Chemical Composition" (published in the Agricultural Ledger No. 7 of 1903, Food-grains and Fodders) the author gives the following analyses of the Grains and Fodder of Setaria italica :—

	Moisture.	Oil.	Albuminoids.	Soluble carbo-hydrates.	Woody Fibre.	Soluble mineral matter.	Sand and Silica.	Total Nitrogen.	Albuminoid Nitrogen.
GRAIN.									
"Rala," Poona	7·75	4·54	10·37	67·19	5·22	1·44	1·49	1·68	1·66
"Kangni," Panjab	10·11	4·96	10·50	67·81	6·29	1·74	2·59	1·75	1·68
"Swank," Panjab	10·25	4·33	10·62	65·37	6·18	2·25	1·00	2·07	1·70
"U. Rai-Soh," Hill Districts, Assam.	11·96	3·46	10·25	62·79	6·23	2·98	2·33	1·72	1·64
4 Samples, average	10·02	4·32	10·44	65·29	5·98	2·10	1·85	1·80	1·67
GREEN FODDER.									
"Kangni," Panjab ..	76·79	·54	2·08	10·08	6·37	1·82	2·32	4·8	3·32
.. Dry State ...	10·00	2·09	8·07	39·11	24·71	7·06	9·00	1·86	1·28

EXPLANATION OF PLATES.

I. Setaria glauca.

II. Setaria italica (type).

III. Setaria italica, *var.* barbata.

IV. Setaria italica, *var.* purpurea.

V. Setaria italica, *var.* typhoidea.

The letters and figures refer to identical parts in all:—

A. A spike with the uppermost leaf (*nat. size*).

B. A cluster of spikelets (*nat. size*).

C. A single spikelet (*enlarged*).

D. 1 = Gl. I; 2 = Gl. II; 3 = Gl. III and its *pale*. 4 = Gl. IV and its *pale*.
5 = Fertile flower (*all enlarged*).

PLATE I.

Setaria glauca

M.G.S.

PLATE II

Setaria italica (type)

M.G.S.

PLATE III.

Setaria italica, var. barbata

M.G.S.

PLATE IV.

Setaria italica, var. purpurea

M.G.S.

PLATE V.

Setaria italica, var. typhoidea

M. G. S.

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